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OBLON, SPIVAK, MCCLELLAND MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			EXAMINER LEWIS, BEN	
			ART UNIT 1795	PAPER NUMBER
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

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# Office Action Summary

## Application No.

10/810,715

## Applicant(s)

SATO ET AL.

## Examiner

Ben Lewis

## Art Unit

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☐ Responsive to communication(s) filed on \_\_\_\_.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1, 7-11, 24 and 35 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 7-11, 24 and 35 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 March 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-8508)
- Paper No(s)/Mail Date 7/8/08

- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date: \_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on July 21<sup>st</sup>, 2008 has been entered.

### **Claim Rejections - 35 USC § 103**

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 11 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (U.S. Pub. No. 2002/0182460 A1) in view of Muller et al. (U.S. Patent No. 6,777,116 B1) and further in view of Pan et al. et al. (U.S. Pub. No. 2004/0110046 A1).

With respect to claims 1 and 25, Okamoto disclose a fuel cell power plant (title) wherein the fuel cell power plant is provided with a water tank **1** and a methanol tank **2** "fuel tank", a vaporizer **5** which vaporizes the water and methanol, a reformer **6** which generates reformat gas from the gaseous mixture of water vapor and methanol vapor, and a carbon monoxide oxidizer **7** which removes carbon monoxide (CO) from the reformat gas (Paragraph 0022). A reformer **6** generates hydrogen rich gas from vaporized methanol and a fuel cell stack **8** generates electric power by a reaction of hydrogen rich gas (See Abstract).

Okamoto does not specifically mention wherein the fuel includes dimethyl ether. However, Muller et al. disclose a direct dimethyl ether fuel cell (title) wherein in a direct dimethyl ether fuel cell, a fuel stream comprising dimethyl ether is supplied directly to the fuel cell anode for direct oxidation therein. Thus, a direct dimethyl ether fuel cell system comprises a system for supplying a dimethyl ether fuel stream to the anode. The fuel stream may contain other reactants and may desirably be supplied as a liquid. For instance, water is a reactant and the fuel stream may be an aqueous solution of dimethyl ether (Col 3 lines 38-55). Muller et al. also teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other fuel cell types. For instance, an efficiency advantage may be obtained over direct methanol fuel cells (Col 4 lines 7-22). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the dimethyl ether of Muller et al. as a fuel in the fuel cell system of Okamoto because Muller et al. teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other

fuel cell types. For instance, an efficiency advantage may be obtained over direct methanol fuel cells (Col 4 lines 7-22).

Muller et al. teach that if methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency (Col 5 lines 60-67). Okamoto does not specifically teach a single fuel tank storing a fuel comprising ether, water and an alcohol. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a single tank for the fuel of Okamoto because making separate components integral is considered obvious. In re Larson, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965) (A claim to a fluid transporting vehicle was rejected as obvious over a prior art reference which differed from the prior art in claiming a brake drum integral with a clamping means, whereas the brake disc and clamp of the prior art comprise several parts rigidly secured together as a single unit. The court affirmed the rejection holding, among other reasons, "that the use of a one piece construction instead of the structure disclosed in [the prior art] would be merely a matter of obvious engineering choice.")

Okamoto as modified by Muller et al. do not specifically mention wherein the fuel includes less than 10wt% methanol. However, Pan et al. disclose a fuel delivery system (title) wherein the optimal range of the fuel concentration is determined based on the type of the fuel cell and the intended usage of the fuel cell. For example, the optimal fuel concentration for a direct methanol fuel cell may range from 3%-5% by weight in order to minimize fuel crossover. However, if the fuel cell is to be used in an application that requires high power output, the optimal range of fuel concentration may become

5%-10% by weight (Paragraph 0032). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the methanol concentration of Pan et al. et al. into the fuel cell system of Okamoto as modified by Muller et al. because Pan et al. et al. teach that the optimal fuel concentration for a direct methanol fuel cell may range from 3%-5% by weight in order to minimize fuel crossover (Paragraph 0032).

With respect to wherein the fuel includes dimethyl ether water and methanol, the disclosure Okamoto et al as modified by Muller et al. and Pan et al. differs from Applicant's claims in that Okamoto et al. as modified by Muller et al. and Pan et al. do not disclose wherein the mixing ratio of dimethyl ether and water is in a range of 1:3 and 1:4. However, Muller et al. recognize the need to increase the concentration of dimethyl ether in a dimethyl ether, methanol and water mixture. Muller et al. teach that If methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency (Col 5 lines 60-67). . Therefore, it would have been within the skill of the ordinary artisan to adjust the DME/ water ratio in the methanol/DME/ water mixture of Okamoto et al. as modified by Muller et al. and Pan et al. such that the DME/water ratio is within the applicants claimed DME/water ratio range in order to obtain higher efficiency during low fuel cell loads. *Discovery of optimum value of result effective variable in known process is ordinarily within skill of art.* In re Boesch, CCPA 1980, 617 F.2d 272, 205 USPQ215.

With respect to claim 11, Okamoto teach that the Specifically, the reformer 6 generates hydrogen by oxidizing methanol in the presence of an oxidation catalyst (Paragraph 0025). Regarding shift catalyst, Okamoto teach that the carbon monoxide oxidizer 7 performs catalytic combustion due to the preferential oxidation of the carbon monoxide in the reformat gas to generate hydrogen-rich gas with a low level of carbon monoxide, using noble metal catalysts such as ruthenium (Ru) and platinum (Pt) (Paragraph 0026).

With respect to claim 24, Muller et al. teach that if methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency (Col 5 lines 60-67). Okamoto does not specifically teach a single fuel tank storing a fuel comprising ether, water and an alcohol. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a single tank for the fuel of Okamoto because making separate components integral is considered obvious. In re Larson, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965) (A claim to a fluid transporting vehicle was rejected as obvious over a prior art reference which differed from the prior art in claiming a brake drum integral with a clamping means, whereas the brake disc and clamp of the prior art comprise several parts rigidly secured together as a single unit. The court affirmed the rejection holding, among other reasons, "that the use of a one piece construction instead of the structure disclosed in [the prior art] would be merely a matter of obvious engineering choice.")

4. Claims 7 and 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (U.S. Pub. No. 2002/0182460 A1) in view of Muller et al. (U.S. Patent No. 6,777,116 B1) and further in view of Yonestu et al. (U.S. Patent No. 6,506,513 B1).

With respect to claim 7, Okamoto as modified by Muller et al. disclose a fuel cell in paragraph 3 above. Okamoto as modified by Muller et al. do not specifically mention wherein the tank comprises a cartridge unit, a valve unit, a holding unit and a supplying unit. However, Yonestu et al. disclose a liquid fuel-housing tank for fuel cell (title) Yonsetu et al. teaches a fuel tank **1** "cartridge", a valve **23**, a connecting section **33** "holding member" and a pathway **3** "supply unit" (Col 10 lines 40-67) (See Figs 10A, 11A and 12). Yonsetu et al. also teach that it is required that the fuel be taken out from the tank stably so as to obtain a stable output, and that the fuel cell has the high performance of the initial rising characteristics. Since the rising characteristics depends on the initial flow rate of the fuel from the fuel tank into the fuel cell body, it is necessary to supply the fuel promptly to the fuel cell body. In other words, it is required that the fuel tank has a mechanism for promptly supplying the fuel in the initial period (Col 2 lines 10-25). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the fuel tank of Yonsetu et al. into the fuel cell system of Okamoto as modified by Muller et al. because Yonsetu et al. teach that it is required that the fuel be taken out from the tank stably so as to obtain a stable output, and that the fuel cell has the high performance of the initial rising characteristics.



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Since the rising characteristics depends on the initial flow rate of the fuel from the fuel tank into the fuel cell body, it is necessary to supply the fuel promptly to the fuel cell body (Col 2 lines 10-25).

With respect to claim 8, Muller et al. teach that if methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency (Col 5 lines 60-67).

5. Claim 9 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (U.S. Pub. No. 2002/0182460 A1) in view of Muller et al. (U.S. Patent No. 6,777,116 B1) and further in view of Suzuki et al. (U.S. Pub. No. 2002/0068206A1).

With respect to claim 9, Okamoto as modified by Muller et al. disclose a fuel cell system in paragraph 3 above. Okamoto as modified by Muller et al. do not specifically mention a vacuum heat insulation container containing the combustor, containing the vaporizer, the reformer and the CO gas removal apparatus. However, Suzuki et al. discloses a fuel cell power system wherein the first hydrogen storage vessel 11, the catalytic combustor 17 and the first three way valve 15 are housed within a thermal insulation housing 25 having a vacuum insulation structure. The thermal insulation housing 25 prevents the combustion heat generated by the catalytic combustor 17 from diffusing outside the system and maintains the temperature of the first hydrogen storage

vessel 11 at about 250 °C to about 280 °C (Paragraph 0019). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the vacuum heat insulation housing of Suzuki et al. to contain the combustor, vaporizer, reformer and CO gas removal apparatus of Okamoto as modified by Muller et al. because Suzuki et al. teach that the thermal insulating housing maintains the temperature of the system components within the housing (Paragraph 0019).

6. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (U.S. Pub. No. 2002/0182460 A1) in view of Muller et al. (U.S. Patent No. 6,777,116 B1) and further in view Kaneko et al. (U.S. Pub. No. 2001/0021469 A1).

With respect to claim 10, Okamoto as modified by Muller et al. disclose a fuel cell system in paragraph 3 above. Okamoto teach that, specifically, the reformer 6 generates hydrogen by oxidizing methanol in the presence of an oxidation catalyst (Paragraph 0025).

Okamoto as modified by Muller et al. do not specifically mention a reforming catalyst of an alumina and at least one material selected from the group consisting of Rh, Pd, Pt and Cu. However, Kaneko et al. disclose a methanol reforming catalyst wherein, the methanol reforming catalyst may contain other component except the catalytic compound. For example, in order to enlarge a reaction surface area, large specific surface area base material such as alumina, silica, or the like, that is

impregnated with the above catalytic compound, may be used (Paragraph 0038).

Kaneko et al. also teach that Pd component is alloyed with Zn, generation of CO due to the above methanol decomposition reaction expressed by following Eq. (f2) can be suppressed while holding the high temperature stability (Paragraph 0032). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the alumina and palladium of Kaneko et al. as reforming catalyst in the reformer of Okamoto as modified by Muller et al. because Kaneko et al. teach that in order to enlarge a reaction surface area, large specific surface area base material such as alumina, silica, or the like, that is impregnated with the above catalytic compound, may be used (Paragraph 0038) and methanol decomposition can be suppressed using Pd/Zn catalyst (Paragraph 0032).

7. Claim 35 is rejected under 35 U.S.C. 103(a) as being unpatentable over Okamoto (U.S. Pub. No. 2002/0182460 A1) in view of Muller et al. (U.S. Patent No. 6,777,116 B1), Pan et al. et al. (U.S. Pub. No. 2004/0110046 A1), Yonestu et al. (U.S. Patent No. 6,506,513 B1), Kaneko et al. (U.S. Pub. No. 2001/0021469 A1) and Suzuki et al. (U.S. Pub. No. 2002/0068206A1).

With respect to claim 35, Okamoto disclose a fuel cell power plant (title) wherein the fuel cell power plant is provided with a water tank **1** and a methanol tank **2** "fuel tank", a vaporizer **5** which vaporizes the water and methanol, a reformer **6** which generates reformat gas from the gaseous mixture of water vapor and methanol vapor,

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and a carbon monoxide oxidizer **7** which removes carbon monoxide (CO) from the reformat gas (Paragraph **0022**). A reformer **6** generates hydrogen rich gas from vaporized methanol and a fuel cell stack **8** generates electric power by a reaction of hydrogen rich gas (See Abstract).

Okamoto does not specifically mention wherein the fuel includes dimethyl ether. However, Muller et al. disclose a direct dimethyl ether fuel cell (title) wherein in a direct dimethyl ether fuel cell, a fuel stream comprising dimethyl ether is supplied directly to the fuel cell anode for direct oxidation therein. Thus, a direct dimethyl ether fuel cell system comprises a system for supplying a dimethyl ether fuel stream to the anode. The fuel stream may contain other reactants and may desirably be supplied as a liquid. For instance, water is a reactant and the fuel stream may be an aqueous solution of dimethyl ether (Col 3 lines 38-55). Muller et al. also teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other fuel cell types. For instance, an efficiency advantage may be obtained over direct methanol fuel cells (Col 4 lines 7-22). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the dimethyl ether of Muller et al. as a fuel in the fuel cell system of Okamoto because Muller et al. teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other fuel cell types. For instance, an efficiency advantage may be obtained over direct methanol fuel cells (Col 4 lines 7-22).

Muller et al. teach that if methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to

obtain higher efficiency (Col 5 lines 60-67). Okamoto does not specifically teach a single fuel tank storing a fuel comprising ether, water and an alcohol. However, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use a single tank for the fuel of Okamoto because making separate components integral is considered obvious. In re Larson, 340 F.2d 965, 968, 144 USPQ 347, 349 (CCPA 1965) (A claim to a fluid transporting vehicle was rejected as obvious over a prior art reference which differed from the prior art in claiming a brake drum integral with a clamping means, whereas the brake disc and clamp of the prior art comprise several parts rigidly secured together as a single unit. The court affirmed the rejection holding, among other reasons, "that the use of a one piece construction instead of the structure disclosed in [the prior art] would be merely a matter of obvious engineering choice.")

Okamoto as modified by Muller et al. do not specifically mention wherein the fuel includes less than 10wt% methanol. However, Pan et al. disclose a fuel delivery system (title) wherein the optimal range of the fuel concentration is determined based on the type of the fuel cell and the intended usage of the fuel cell. For example, the optimal fuel concentration for a direct methanol fuel cell may range from 3%-5% by weight in order to minimize fuel crossover. However, if the fuel cell is to be used in an application that requires high power output, the optimal range of fuel concentration may become 5%-10% by weight (Paragraph 0032). Therefore it would have been obvious to one of ordinary skill in the art to incorporate the methanol concentration of Pan et al. et al. into the fuel cell system of Okamoto as modified by Muller et al. because Pan et al. et al.

teach that the optimal fuel concentration for a direct methanol fuel cell may range from 3%-5% by weight in order to minimize fuel crossover (Paragraph 0032).

With respect to wherein the fuel includes dimethyl ether water and methanol, the disclosure Okamoto et al as modified by Muller et al. and Pan et al. differs from Applicant's claims in that Okamoto et al. as modified by Muller et al. and Pan et al. do not disclose wherein the mixing ratio of dimethyl ether and water is in a range of 1:3 and 1:4. However, Muller et al. recognize the need to increase the concentration of dimethyl ether in a dimethyl ether, methanol and water mixture. Muller et al. teach that If methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency (Col 5 lines 60-67). . Therefore, it would have been within the skill of the ordinary artisan to adjust the DME/ water ratio in the methanol/DME/ water mixture of Okamoto et al. as modified by Muller et al. and Pan et al. such that the DME/water ratio is within the applicants claimed DME/water ratio range in order to obtain higher efficiency during low fuel cell loads. *Discovery of optimum value of result effective variable in known process is ordinarily within skill of art.* In re Boesch, CCPA 1980, 617 F.2d 272, 205 USPQ215.

Okamoto as modified by Muller et al. and Pan et al. do not specifically mention wherein the tank comprises a cartridge unit, a valve unit, a holding unit and a supplying unit. However, Yonestu et al. disclose a liquid fuel-housing tank for fuel cell (title) Yonsetu et al. teaches a fuel tank **1** "cartridge", a valve **23**, a connecting section **33** "holding member" and a pathway **3** "supply unit" (Col 10 lines 40-67) (See Figs 10A, 11A and 12). Yonsetu et al. also teach that it is required that the fuel be taken out from

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the tank stably so as to obtain a stable output, and that the fuel cell has the high performance of the initial rising characteristics. Since the rising characteristics depends on the initial flow rate of the fuel from the fuel tank into the fuel cell body, it is necessary to supply the fuel promptly to the fuel cell body. In other words, it is required that the fuel tank has a mechanism for promptly supplying the fuel in the initial period (Col 2 lines 10-25). Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the fuel tank of Yonsetu et al. into the fuel cell system of Okamoto as modified by Muller et al. and Pan et al.. because Yonsetu et al. teach that it is required that the fuel be taken out from the tank stably so as to obtain a stable output, and that the fuel cell has the high performance of the initial rising characteristics. Since the rising characteristics depends on the initial flow rate of the fuel from the fuel tank into the fuel cell body, it is necessary to supply the fuel promptly to the fuel cell body (Col 2 lines 10-25).

Okamoto teach that, specifically, the reformer 6 generates hydrogen by oxidizing methanol in the presence of an oxidation catalyst (Paragraph 0025).

Okamoto as modified by Muller et al., Pan et al. and Yonsetu et al. do not specifically mention a reforming catalyst of an alumina and at least one material selected from the group consisting of Rh, Pd, Pt and Cu. However, Kaneko et al. disclose a methanol reforming catalyst wherein, the methanol reforming catalyst may contain other component except the catalytic compound. For example, in order to enlarge a reaction surface area, large specific surface area base material such as alumina, silica, or the like, that is impregnated with the above catalytic compound, may

be used (Paragraph 0038). Kaneko et al. also teach that Pd component is alloyed with Zn, generation of CO due to the above methanol decomposition reaction expressed by following Eq. (f2) can be suppressed while holding the high temperature stability (Paragraph 0032).

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the alumina and palladium of Kaneko et al. as reforming catalyst in the reformer of Okamoto as modified by Muller et al., Pan et al. and Yonsetu et al. because Kaneko et al. teach that in order to enlarge a reaction surface area, large specific surface area base material such as alumina, silica, or the like, that is impregnated with the above catalytic compound, may be used (Paragraph 0038) and methanol decomposition can be suppressed using Pd/Zn catalyst (Paragraph 0032).

Okamoto as modified by Muller et al., Pan et al., Yonsetu et al. and Kaneko et al. do not specifically mention a vacuum heat insulation container containing the combustor, containing the vaporizer, the reformer and the CO gas removal apparatus. However, Suzuki et al. discloses a fuel cell power system wherein the first hydrogen storage vessel 11, the catalytic combustor 17 and the first three way valve 15 are housed within a thermal insulation housing 25 having a vacuum insulation structure. The thermal insulation housing 25 prevents the combustion heat generated by the catalytic combustor 17 from diffusing outside the system and maintains the temperature of the first hydrogen storage vessel 11 at about 250 °C to about 280 °C (Paragraph 0019).



Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to incorporate the vacuum heat insulation housing of Suzuki et al. to contain the combustor, vaporizer, reformer and CO gas removal apparatus of Okamoto as modified by Muller et al., Pan et al., Yonsetu et al. and Kaneko et al because Suzuki et al. teach that the thermal insulating housing maintains the temperature of the system components within the housing (Paragraph 0019).

### ***Response to Arguments***

7. Applicant's arguments filed on July 21<sup>st</sup>, 2008 have been fully considered but they are not persuasive.

*Applicant's principal arguments are*

(a) Applicants disagree with the underlying presumption in the rejection under 35 USC 103(a) combining Okamoto with Muller and Pan (and others) because the combination of art does not provide any suggestion for the claimed fuel components in the ratios defined in a fuel cell also including a reformer and indeed provide no indication as to how DME contributes to the reforming reaction in the fuel cell. That the art does not provide the requisite disclosure that would lead one to the claimed invention, the claims

cannot be considered obvious. However, presuming that the Office sticks to the rationale alleged in the rejections, there is nothing in what has been cited in the rejection that minimizes or contradicts the Applicants surprising findings for the claimed fuel, in the claimed mixing ratio, in the type of fuel cell being claimed. Thus, the claims would not have been obvious as the combination defined in the claims yields more than "a predictable result." (see *KSR Intern. Co. v. Teleflex, Inc.*, 127S.Ct. 1727 (2007)).

(b) First, the type of Muller et al.'s and Pan's fuel cell are completely different from the one defined in the claims, i.e. Muller's fuel cell and Pan's fuel cell are "direct dimethyl ether fuel cell" which do not include a reformer. As Muller et al. do not teach or suggest the reformer, one of ordinary skill in the art would not recognize how DME contributes to the reforming reaction in the Applicant's reformer and therefore Muller does not provide any of the requisite teachings that would lead one to (A) include DME in the type of fuel cell claimed; nor (B) adjust the mixing ratio of DME and water because the mechanism of steam reforming of higher hydrocarbons (such as DME) is more complex.

(c) What about Pan which is cited for the amount of methanol and to optimize fuel compositions depending on use (see page 4 of the Action, last paragraph)? As already noted, Pan's fuel cell is different than that which is claimed and therefore what is applicable in Pan's fuel cell is not necessarily so for other fuel cells, like that in Okamoto or that in the claims. Moreover, Pan et al.'s fuel cell type is completely different from

Applicant's fuel cell type. Pan et al. merely disclose a type of "direct fuel cell" which does not include a "reformer"

In response to Applicant's arguments, please consider the following comments.

(a) In response, Examiner notes that Okamoto et al as modified by Muller et al. and Pan et al. differs from Applicant's claims in that Okamoto et al. as modified by Muller et al. and Pan et al. do not disclose wherein the mixing ratio of dimethyl ether and water is in a range of 1:3 and 1:4. However, Muller et al. recognize the need to increase the concentration of dimethyl ether in a dimethyl ether, methanol and water mixture. Muller et al. teach that If methanol/DME/water fuel streams are employed, it might be desired to increase the DME concentration during low fuel cell loads in order to obtain higher efficiency (Col 5 lines 60-67). . Therefore, it would have been within the skill of the ordinary artisan to adjust the DME/ water ratio in the methanol/DME/ water mixture of Okamoto et al. as modified by Muller et al. and Pan et al. such that the DME/water ratio is within the applicants claimed DME/water ratio range in order to obtain higher efficiency during low fuel cell loads. Discovery of optimum value of result effective variable in known process is ordinarily within skill of art. In re Boesch, CCPA 1980, 617 F.2d 272, 205 USPQ215

Furthermore, with respect to the combination of the Okamoto and Pan references, the examiner recognizes that obviousness can only be established by combining or

modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, it would have been obvious to one of ordinary skill in the art to incorporate the dimethyl ether of Muller et al. as a fuel in the fuel cell system of Okamoto because Muller et al. teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other fuel cell types. For instance, an efficiency advantage may be obtained over direct methanol fuel cells (Col 4 lines 7-22).

(b) In response to applicant's argument that "the type of Muller et al.'s and Pan's fuel cell are completely different from the one defined in the claims", examiner notes that the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). It would have been obvious to one of ordinary skill in the art to incorporate the dimethyl ether of Muller et al. as a fuel in the fuel cell system of Okamoto because Muller et al. teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other fuel cell types. For

instance, an efficiency advantage may be obtained over direct methanol fuel cells (Col 4 lines 7-22). Examiner notes that Muller et al. was used to show that it would have been obvious to one of ordinary skill in the liquid fuel cell art to use dimethyl ether fuel in the system of Okamoto (which has a reformer). Examiner relied on Muller et al. for the teaching of the use of dimethyl ether as a fuel for fuel cells.

(c) In response to applicant's argument that "the type of Muller et al.'s and Pan's fuel cell are completely different from the one defined in the claims", examiner notes that the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). It would have been obvious to one of ordinary skill in the art to incorporate the dimethyl ether of Muller et al. as a fuel in the fuel cell system of Okamoto because Muller et al. teach that particularly at low current densities, a direct dimethyl ether fuel cell may show efficiency advantages over other fuel cell types. For instance, an efficiency advantage may be obtained over direct methanol fuel cells (Col 4 lines 7-22). Examiner notes that Muller et al. was used to show that it would have been obvious to one of ordinary skill in the liquid fuel cell art to use dimethyl ether fuel in the system of Okamoto (which has a reformer). Examiner relied on Muller et al. for the teaching of the use of dimethyl ether as a fuel for fuel cells.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ben Lewis whose telephone number is 571-272-6481. The examiner can normally be reached on 8:30am - 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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